Ref #121

631

UNITED STATES DEPARTMENT OF AGRICULTURE

BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE

RLF

Project	Date	Author

SUBJECT—

TITLE

FOREST INSECT CONDITIONS HELENA NATIONAL FOREST, MONTANA SEASON OF 1948

FILE No.
Refer to:
Entered by:

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January 11, 1949

INDEX No.—

U.S. GOVERNMENT PRINTING OFFICE 8—9742

Rec'd. Portland. 9/29/49

UNITED STATES DEPARTMENT OF AGRICULTURE

BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE

Forest Insect Laboratory
Coeur d'Alene, Idaho

FOREST INSECT LABORATORY
FORT COLLINS, COLORADO
JAN 20 1949
BUREAU OF ENTOMOLOGY & PLANT QUARANTINE U. S. DEPT. OF AGRICULTURE

January 14, 1949

Wygant
Buchanan
Mason

To: N. D. Wygant, F. P. Keen, and R. L. Furniss

From: James C. Evenden, In Charge, Forest Insect Laboratory

Subject: Helena Budworm Survey Report

The attached report is to be routed for filing at Portland. We thought you might be interested in this report which is devoted primarily to the findings of a special spruce budworm survey made on the Helena National Forest, Montana, in October at Dr. Craighead's request. At the time the survey was made discussions were under way with Mr. Mason's office in Washington over the possibility of carrying out an experimental control operation against some of the Helena infestations in 1949. As you know, it was decided to concentrate all efforts in this direction on the large-scale experimental project planned for Oregon this year.

We feel the report is of interest in describing the conditions under which so many budworm infestations are flourishing in the northern Rockies and in showing what kind and amount of damage has occurred. One thing which came out in the preparation of this report is the lack of standards and, perhaps, uniformity in describing infestations of defoliating insects. Our bark beetle surveys in the West are conducted along well defined lines developed over the years, but our defoliator surveys are still pretty much of an interpretation by individuals using whatever methods can be devised on the spot. Mr. Johnson was faced with this dilemma on the Helena survey and attempted to describe the situation by an arbitrary classification of the degree of damage. We went through the same stage on the 1947 tussock moth job and had to devise a method of describing the infestation so that our pre-control survey crews were all speaking the same language.

It is our thought here that we need to do some work on developing defoliator insect survey methods just as we have done for our bark beetle surveys. We do not know how you may feel about this need, but with us in this region, the growing urge by cooperators to want

to do something about the defoliator problems is making us devote more and more time to them. If our surveys can be expanded to give more adequate coverage to them then our methods will have to be more specific. Your comments would be appreciated.

James C. Evenden
P.C.F.

cc: Craighead

FOREST INSECT CONDITIONS

Helena National Forest, Montana

Season of 1948

Late in October 1948 an examination of the Helena National Forest, Montana was hurriedly planned and executed to determine the extent and severity of current infestations of the spruce budworm (Archips fumiferana Clem.). This was prompted by a request from the Beltsville, Maryland and Washington, D. C. offices of the Bureau of Entomology and Plant Quarantine and the Forest Service respectively for information on possible working areas for a proposed experimental program of spruce budworm control by aerial spraying in 1949 under provisions of the recently enacted Forest Pest Act. This information has been supplied though it necessarily had to be rather sketchy.

This report enlarges upon this information as a matter of record, being strengthened materially by more adequate timber resource data than it was possible to assemble at the time the preliminary estimates of budworm damage were made. It also includes a general discussion of bark beetle conditions now current on the Forest which were noted for the most part during the course of the budworm examination.

The basic information contained herein came from two separate examinations of the Helena National Forest. The first was a reconnaissance, admittedly very brief, of budworm infestations in the Deep Creek drainage east of Townsend and in the Canyon Creek drainage north of the small community of the same name and of bark beetle infestations in the Lincoln Basin. This was made by Messrs. James C. Evenden and the writer of this laboratory and Donald E. Parker, Assistant Chief, Division of Forest Insect Investigations, Beltsville, Maryland, on October 15 - 16, 1948.

The second examination, made by the writer, was made October 21 - 24, 1948, and was primarily a budworm survey. An extensive network of forest roads was used to reach locations from which most of the forested areas could be seen at close range. Many of the roads traversed the infested areas and enabled more detailed examinations to be made of the infestations encountered. Excellent weather and dry roads helped materially to carry the examination to most all parts of the infested portions of the Forest.

SPRUCE BUDWORM DAMAGE

The two field examinations disclosed that the damage caused to Douglas fir stands is indeed serious. Over 250,000 acres of dense young stands were seen to be severely defoliated by infestations which have persisted for the past five or more years. On about 7,000 acres of this total the trees have been completely killed. An additional 116,000 acres are showing severe damage from more recent infestations. In addition to the quarter million acres of budworm-ridden fir forests covered by the surveys are some 150,000 - 200,000 acres in which light infestations are believed to be present.

Current infestations viewed during the examinations are concentrated into two major subdivisions of the Forest; (1) the Continental Divide (Helena Ranger District) where damage as of 1948 is light to moderately severe and (2) the Big Belt Mountains (Canyon Ferry and Townsend Ranger Districts) where damage runs from light to extremely severe (See map). The Douglas fir stands in both subdivisions are arranged in even-aged blocks representing most all age categories. The blocks which have sustained the heavier damage are extremely dense and contain trees approximately 50 - 75 years old ranging in size from 4 to 10 inches d.b.h. and to about 50 feet in height.

The survey based the severity of the budworm infestations almost entirely upon the amount of damage which had occurred. The damage, consisting of defoliation of the infested trees, was somewhat variable depending upon the severity of feeding in any one year and the number of years the trees have been infested. This is because the budworm larvae normally prefer to feed upon the current, or new, foliage.

Where the infestation has been under way for only a year or two the damage is relatively slight (Figure 1). When the infestation has persisted over a longer period the year-to-year destruction of terminal foliage produces a very thinned out crown which can lead to total defoliation of the tree in time (Figure 2). This same effect has been achieved in one year upon rare occasion by the feeding upon both new and old foliage by an unusually heavy budworm population. However, this kind of an infestation probably has not occurred in recent years on the Helena National Forest.

Since the intensity of a budworm infestation is best understood by the amount of damage it causes an arbitrary classification of damage has been devised (Table 1) in order that a more adequate description of the damage in specific areas can be given later in the report.

Figure 1. An example of heavy current defoliation but light total defoliation caused by the loss of the 1947 and 1948 needle growth from spruce budworm feeding in those years. Branch taken from point near Marysville, Montana. (1330)

Figure 2. Heavy current and total defoliation from White Gulch, Big Belt Mountains. Here, heavy budworm feeding during the past 5 or 6 years has nearly stripped many trees of all their foliage. (1329)

Table 1. Classification of damage by spruce budworm infestations, Helena National Forest, Montana, 1948.

Classification of Damage	Percent of Defoliation		Probable Cause
	1948 Needles	Older Needles	
Light	100	0-10	Feeding upon 1948 needles only.
Moderate	100	10-25	Year-by-year feeding upon current needles since 1946.
Heavy	100	25-75	Year-by-year feeding upon current needles since 1944.
Severe	100	75-100	Year-by-year feeding upon current needles since before 1944.

In listing the probable causes for the different degrees of defoliation shown in Table 1, it has been assumed that the budworm has fed only on the current growth from year to year in any one locality. Hence, the amount of defoliation is almost directly proportional to the number of years the infestation has been active in that area. If Douglas fir needles were retained on the twigs, say, for 7 years and the budworm restricted its feeding only to the current needles each year, theoretically it would take 7 years to completely defoliate the tree. When the budworm population is extremely heavy in any one year it will feed on the older needles. Even though the budworm is known to have been active in certain sections of the Helena for 6 or 7 years, trees in those areas today are no more than moderately defoliated. It seems, therefore, that some of the heavy and severe defoliation seen on the Helena this year could conceivably have resulted from the feeding of a concentrated population in the past 1 to 3 years instead of 5 to 7 years as indicated in Table 1.

Continental Divide

Budworm infestations on this part of the Helena National Forest occur in Douglas fir forest types immediately east of the summit of the summit of the Continental Divide between the Helena mainline of the Northern Pacific Railway on the south and the northern boundary of the Little Prickly Pear Creek watershed on the north.

The heaviest budworm damage, classified as light to moderate, was found in the Marysville-Edward Mountain-Piegan Creek sector. Here, the top 3 to 5 feet and the terminals of the lateral branches were almost completely stripped of needles on the trees, which were 25 to 50 feet in height and about 30 to 50 years of age. The missing foliage was chiefly that of the 1947 and 1948 growth seasons.

Elsewhere in the infested zone the damage was light, being confined mostly to partial loss of the 1948 needle growth. In many areas this was barely perceptible except at very close range. An estimate of the acreage damaged in this area is given in Table 2.

Big Belt Mountains

This local range of mountains comprises the eastern part of the Helena National Forest. It lies east of and parallel to the Continental Divide from which it is separated by a distance of approximately 35 miles in the vicinity of the city of Helena.

Most of the forest cover in each drainage occurs at 4,000 feet elevation or higher and consists primarily of Douglas fir. From 4,000 to 5,000 feet it occurs almost entirely on the north exposures. Since the south slopes are either grass or pine-covered, this has the effect of breaking up the fir into separate blocks. At the higher elevations, however, these blocks are joined together to bridge the upper reaches of the drainages and form a mantle of dense fir cover along the summit of the Big Belts. Except in a few places the fir forests do not extend eastward beyond the summit a very great distance since the eastern slopes drop very briefly and gently to extensive open rangelands.

Trout Creek.

Little budworm damage was seen along the lower end of this drainage, but the fir trees have been quite heavily infected by the Douglas fir needle blight, Rhabdocline pseudotsugae Syd., Above the spectacular Trout Creek Canyon, however, light to moderate budworm damage was observed both in the main Trout Creek drainage and in the Indian Creek branch. Engelmann spruce in the latter

drainage, though mixed with infested Douglas fir, does not seem to have been damaged appreciably by the budworm.

Avalanche Creek

Light budworm damage was noted in conjunction with heavy 1948 Rhabdocline infection along both sides of this drainage from the national forest boundary east to Cayuse Creek. Between Cayuse Creek and Tick Gulch, and in Tick Gulch itself, moderate to heavy budworm damage was prevalent in the dense fir stands which clothe the slopes from stream bottom to summit. This damage was noticeable enough near the mouth of Tick Gulch to be clearly visible for several miles. From this distance, the forest appeared to have a brownish-gray cast.

In the extreme upper end of Avalanche Creek above it's confluence with Thompson Creek, the damage from the budworm infestation became gradually lighter. Along the summit above Avalanche Creek are approximately one or two million board feet of old growth Douglas fir of sawlog size. The budworm has injured these trees very little thus far which is indeed fortunate because of the relatively high commercial value of this timber. However, it is almost entirely surrounded by heavily infested young-aged fir forests which now serve as a potential source of contamination.

White Gulch

This drainage is perhaps the center of spruce budworm activity on the Helena National Forest. Certainly the fir stands in this drainage are the most severely damaged of any seen during the two field examinations. Upon entering the gulch from its lower end one soon encounters fairly light 1948 budworm damage, beginning at the forest boundary and extending along the north slopes south of the main stream to a point opposite Horse Gulch. There is little fir along the southern exposure north of the stream in this same distance. However, a well timbered knoll at the head of #16 Gulch appeared to have been heavily damaged.

East from Horse Gulch budworm damage becomes very severe on both sides of White Gulch (Figures 3 and 4). Approximately 4,000 acres of dense 50 year-old Douglas fir forests appeared to have been completely defoliated. The remainder of the forest cover as far north as the line between Townships 10 and 11 north has been stripped of about half of its foliage. From that point to the summit, and along the summit, the damage has been light.

Figure 3. Heavy budworm damage in Douglas fir stands in White Gulch, near Horse Gulch. Defoliated crowns show a decided grayish cast near horizon. (1362)

Figure 4. Dense Douglas fir forests shown here near Miller Gulch suffered loss of nearly half of entire foliage. Note defoliated tree in right foreground. (1360)

Vermont and Benton Gulches

Seen from a distance, the damage from 1948 budworm infestations appeared to be moderately heavy and uniformly distributed.

Cement and Confederate Gulches

Light to moderate damage. It appeared from this that the intensity of the 1948 budworm infestations was tapering off as they progressed southward from the point of heaviest damage (White Gulch).

Duck Creek

Damage was light in a belt extending along the west slope of the Big Belts between Boulder Mountain and Mount Baldy. The comparatively high elevations of these two peaks and the intervening ridge limits the upper margin of the fir belt to a line about midway between the forest boundary and the summit.

Moderately heavy damage was noted on north exposures immediately south of Duck Creek between Duck Creek Guard Station on the west to the road joining this and the Gurnett Creek drainage to the south.

Deep Creek

Light to moderate damage occurred in dense stands of 50 - 100 year-old Douglas fir in the north fork of Deep Creek. Except for occasional small spots of light damage the main fork of Deep Creek was almost free of damage from 1948 budworm feeding.

Table 2. Spruce budworm infested Douglas fir forest acreage, by degree of damage. Helena National Forest, Montana. 1948.

Subdivision	Area	Degree of Damage			
		Light	Moderate	Heavy	Severe
Continental Divide	Marysville	26,830	7,990		
Big Belt Mountains	Beaver-Coup Crs.	41,980			
(West slope)	Trout Creek	14,950	14,030		
	Magpie Creek	3,380	20,790		
	Avalanche Creek		5,020	9,010	2,970
	White Gulch			5,320	3,990
	Confederate Gulch		4,200	3,280	
	Duck-Ray Creeks	4,400	3,580	1,130	
	Deep Creek	4,850	9,830		
	Dry Creek	5,220	5,730		
Big Belt Mountains	16-Mile Creek	23,240			
(East slope)	Birch Creek	1,020			
	Camas Creek	810			
	Rock Creek	4,100			
	Dry Range	7,070	8,500		
	Antelope Creek		4,200		
	Keep Cool- Elk Crs.		4,820		
	Faulkner Creek		2,050		
	Benton-Vermont Guls.			7,270	
	TOTALS	137,850	90,740	26,010	6,960

BARK BEETLE DAMAGE

The most serious of several bark beetle infestations on the Forest in 1948 is centered on private lands near the town of Lincoln. The situation is not new but has existed for several years. A fairly complete estimate of the damage wrought by the mountain pine beetle (Dendroctonus monticolae Hopk.) in ponderosa pine in this vicinity was made by this laboratory in 1945.[1] At that time the beetle-killed trees varied from 0.1 to 1.7 trees per acre over about 12,000 acres of privately-owned ponderosa pine forests within a 3 or 4-mile radius to the north, west and south of Lincoln townsite. The loss on national forest land outside this perimeter was considerably less.

No samples were taken of the beetle damage which occurred here in 1948, but it believed to be far less than the 1945 loss figures. In effect, this means that the infestation as a whole has declined to normalcy except in one or two small areas on privately-owned land northwest of Lincoln.

Several small concentrations of Douglas fir trees killed by the Douglas fir beetle (D. pseudotsugae Hopk.) were noted in a few localities of the Big Belt Mountains. Four groups of these trees were noted in the Trout Creek drainage as follows: (1) between Beard and Blacksmith Gulches, 150 trees, (2) between Swamp and Goodman Gulches, 100 trees, (3) midway in Trout Creek Canyon, 50 trees, and (4) one-fourth mile southwest of Casey's sawmill in the Indian Creek fork, 25 trees. These groups were made up of trees killed in 1947 for the most part. A few 1948-killed trees were evident, but these were few in number.

A scattering of Douglas fir beetle-killed trees was also noted in White Gulch in conjunction with severe damage by the spruce budworm. An estimated hundred trees currently infested by this beetle were seen in the dense young stand of Douglas fir which stretches along the south side of the gulch between the forest boundary on the west and Miller Gulch. The seriousness of this situation is greater than the number of infested trees indicates because of the liklihood of the beetle attacking many of the almost countless numbers of trees partially or completely defoliated by the budworm in this drainage.

Several other groups of trees killed by the Douglas fir beetle were seen in the main and north forks of Deep Creek east of Townsend. For the most part these groups are small and widely separated and, at present, they do not appear to indicate any real menace to the surrounding fir stands.

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[1] Evenden, James C. Memo to A. C. M. Lumber Company, Bonner, Montana. Mountain pine beetle infestation, ponderosa pine. Forest Insect Laboratory, Coeur d'Alene, Idaho. October 19, 1948.

INSECT CONTROL RECOMMENDATIONS

Early in November 1948 preliminary findings of the spruce budworm survey of the Helena were forwarded to the chiefs of the Division of Forest Insect Investigations of this Bureau and of the Division of Timber Management, Forest Service for their consideration. Notwithstanding the seriousness of the current budworm infestations, it was decided to delay control measures on the Helena until certain control techniques aimed at securing effective reductions in budworm populations can be developed or improved upon. Large scale control operations of an experimental nature are being planned in Oregon during 1949. Results from these and from similar operations conducted there this past year should provide some of the information needed to develop a practical and effective control method for the spruce budworm.

When such a method has been approved steps should be taken to apply it first in such areas as White Gulch, Avalanche Creek, and Confederate Gulch to save the badly damaged forests from being completely killed. Following this much of the Douglas fir forest areas remaining in the Big Belt, Dry Range, and Continental Divide sections of the Forest could be treated to prevent further damage from comparatively new budworm infestations which are now developing.

No bark beetle control measures are necessary at this time.

Figure 5. View to northwest into upper White Gulch. Cayuse Butte in distance. Typical of forest and Topographic conditions prevailing in much of the Big Belt Mountains infested by the spruce budworm. Slope in middle distance heavily infested. Slopes in distance, at higher elevations, lightly infested. Narrow, twisting, deep canyons present a challenge to the tree-top spray flights required in controlling this insect from the air. (1361).

LOCATION AND SEVERITY
of
1945 SPRUCE BUDWORM INFESTATIONS

Helena National Forest
Montana

Douglas Fir Forest Type	Degree of Infestation
	Light
	Moderate
	Heavy
	Severe

MARYSVILLE
BEAVER-SOUP CREEKS
TROUT CR
MAGPIE CR.
AVALANCHE CR.
WHITE GUL.
CONFEDERATE GUL.
ROCK CR.
DRY RANGE
ANTELOPE CR.
BENTON-VERMONT GULS.
KEEP COOL-ELK CRS.
CAMAS CR.
BIRCH CR.
DUCK RAY CRS.
DEEP CR.
DRY CR.
FAULKNER CR.
16-MILE CR.
HELENA
CASCADE CO
MEAGHER CO
LEWIS AND CLARK CO
JEFFERSON CO
POWELL CO
GALLATIN CO
NATIONAL FOREST
GALLATIN NATL FOREST
R. 1 W.
R. 1 E.
R 2 E
R 3 E
R. 4 E.
R. 2 W.
R. 2 E.
R. 3 E
R. 5 E.
R. 6 E.
T. 14 N.
T. 13 N
T. 12 N.
T. 11 N.
T. 10 N.
T. 9 N.
T. 8 N.
T. 7 N.
T. 6 N.
T. 5 N.
T. 4 N.